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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

TECHNICAL MEMORANDUM. 49

ESTABLISHMENT OF AVIATION SCHOOLS.

By

Erich Kempe.

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Translated from
"Flug-Woche," March 16, 1921.

November, 1921.

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The question of the establishment of a suitable aviation school is the subject of animated communications in the "Erfurter Fliegertagung."

The following article from the pen of the active and meritorius leader of the Nuremberg aviation school contains an account of the development of this institution.

Although the observations of Mr. Kempe have been written more from the local point of view, they nevertheless contain valuable suggestions which we would not withhold from our readers.

The Editor.

In the establishment of aviation and other technical schools, the greatest difficulty is to obtain suitable teachers. In selecting them, the highest standards must be maintained. It need not be thought that aviation experts will do. Good aviators and mechanics are mostly poor theorists and instructors. Mathematics and theoretical principles can not be taught by an airplane pilot who is not an actual professional mathematician. Instruction in assembling and making models may be given by practical mechanics, but this must be under the supervision of a professor, so that theory and practice may be combined.

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The object of the instruction in aviation schools should not be to produce aviators, as such, but efficient constructors and thinkers. Flying can be quickly learned at any time, either in connection with the school or related industries.

The whole course of instruction may be conveniently divided into several courses, semesters or years, according to the aims of the institution. If practical aviation is to be taught in the institution, it would be better to leave it till near the end of the entire course.

The subject should be made attractive to the student, however, even during the first year. It is a good plan to take up the historical material, which will furnish entertainment for many a lesson and thus form an agreeable diversion from the dry and difficult material of the elementary subjects.

I have been very successful on these lines in the Nuremberg aviation school. We have always been limited in the choice of subjects in Nuremberg by the fact that our pupils have been only graduates of the elementary public schools. For more advanced students certain courses (for instance, in mathematics) could be replaced by courses in manual training.

In Nuremberg, the course is divided into four years of eight months, with 12 to 16 work hours per week. By increasing the hours per week, the whole course might be divided into several semesters or quarters with a minimum of not less than three semesters.

First year: descriptive geometry and elementary aeronautic

drawing (2 hours per week), history (1), mathematics (4), technics of building materials and fuels (1), elementary aircraft instruction (1). Mathematics and descriptive geometry are absolutely indispensable, if a fitter or technician is to understand his airplane or airship thoroughly. Aside from these required subjects, there are the following electives: German and bookkeeping.

Second year: construction (2), mathematics (2), trigonometry (2), physics (1), elementary engine course (1), mechanics and strength of materials (3), elementary aircraft course (1), electricity (1), practice in assembling engine.

Third year: mathematics and statics (2), engines (4), technical aircraft course with construction (3), manufacturing (2), practice in assembling finished engine.

Fourth year: construction and practical exercises on large gasoline engine (4), making giant airplanes and balloons (3), aerodynamics, differential calculus, goniometry, meteorology (each 1), making models and gliders with practical instruction in flying, in the first three years compulsory (4).

The courses in descriptive geometry, mathematics, trigonometry strength of materials, mechanics, electricity, etc., contain what is ordinarily taught in mechanical engineering, but with special application to aviation. On the other hand, the following are purely practical subjects: technical manufacturing, engine courses I and II, airplane courses I and II, technology and history. To many people history seems superfluous, but I have not found it so. In the first place, I have learned that the history of the evolu-

tion of aviation, with all its interesting stories, like King Bladud, Kaspar Mohr von Schussenried, etc., may be regarded as "sweetening" for the more difficult courses. The eyes of the pupils, older as well as younger, never brighten more than when listening to the recital of these stories. And is it not important to explain with the aid of photographs and sketches the origin of the Montgolfiere and Giffard balloons or the flying machines of Oliver von Malmesbury, G. B. Danti, Leonardo da Vinci, Cayley, Lilienthal, etc., and to show, for example, to what circumstances we are indebted for the modern airplane with its rudder and ailerons and other special features? A knowledgg of the evolution of the many kinds of balloons and flying machines is essential for the general understanding of flight technics. Anyone taking it seriously has sufficient material for a lesson a week for a year.

The technology of building materials and fuel is divided into chemical and mechanical technology with especial reference to airplanes.

The aircraft course is an important one and is divided into elementary and technical courses. The former is subdivided into airship and airplane courses. In connection with airships, the course comprises examples of airship calculations, analytical determination of air resistances, expansion, radius of action, insulation, etc. In connection with airplanes, individual types, gliding flight, construction, landing gear, fuselage, equipment, etc. are taken up. The technical aircraft course comprises calculation

and construction, representation of various forces: thrust, lift, etc., determination of aerofoil shapes, stabilizing, calculation of curves, straight flight, propeller, etc. This course is largely illustrated by original models. The manufacturing course gives an insight into manufacturing, riveting, splicing, autogenous welding, pipe connections, stretching, gluing, sewing, etc. The most important course of all is the one on engines. This is systematically carried out by engine specialists, in calculation, construction and assembling, so far as it concerns practical operations. In all the courses, emphasis is laid on practical exercises, like assembling and dismantling of actual airplanes and especially engines, and making drawings.

The equipment is a very important factor. The library should be complete, including all old as well as new works. There should be models of complete airplanes and of special parts, engines and instruments for inspection. Review lectures, illustrated by pictures, should be given every month. In the model shops, there should always be kept an abundant supply of materials for making models of all kinds and sizes. Every school year should close with visits to aircraft factories and laboratories, as likewise with competitive flights of models, with distribution of prizes.

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